Technological national learning in France : from minitel to internet

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CHAPTER

TECHNOLOGICAL NATIONAL LEARNING: FROM MINITEL TO INTERNET

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In France, the development of the Internet has been influenced by the evolution of the inherited information technology. France had many of the elements needed for the Internet to flourish: excellent engineering schools, participation of scientists and academic researchers in data networks, financial markets with venture capital companies, supportive government, and high incomes. Thus, France had many of the components that constitute the American, or even the Silicon Valley, model. And yet, the internet economy did not begin until some years after the United States, Sweden, and the United Kingdom. Many have argued that the monopoly of France Telecom slowed the Internet's development in France. In this chapter, we shall show that it was instead France's early lead in electronic commerce that hindered this development.

The Internet is the most recent phase of a movement to rationalize and computerize communication. This movement began in the 1960s and has entailed increasingly sophisticated iterations of information and communication technologies (ICT). This incremental revolution makes it hard to characterize Internet usage today, as the technological base underlying the Internet is not limited simply to the latest generations of technology. The various waves of ICT did not simply follow each other; rather, their effect was cumulative and many different layers of technology still co-exist. These successive layers have influenced current forms of organization and communication. Over time, these choices have defined a technological base and determined organizational structures and specific areas of competence.

Information technologies cannot therefore be considered independently and separately from one another. Technologies function in clusters as parts of diverse technical applications.

They require systems that combine defined infrastructure capabilities and autonomous technical applications. They are also embedded in configurations and operational procedures that imply specific organizational forms. Consumer and business demand for ICT rests on declared needs that are poorly defined in terms of the technologies required, their possible uses, and their functional characteristics. Users are confronted with complex needs that can be met only by combinations of services and technologies. There is a trade-off level between the various technologies and the types of services they support. Functionalities overlap each other, and a single technology can be used to fulfill a variety of functions.

Prior experiences with computerization often makes it possible to better prepare, facilitate, orient, and structure the integration of past and recent technological generations. The Minitel, which was launched in the 1980s, encouraged the emergence of a computerized communications sector. More than 17 million people regularly use 25,000 Minitel services, which range from secure access to bank accounts, electronic commerce, and on-line payment systems (including reservation of train or cinema tickets) to communications forums and information searches.

We hypothesize that although the French Minitel slowed the emergence of the Internet, it gave space to what we call a «national learning». This learning can be seen at the level of economic actors, public groups, and users, which together compose a national system of innovation. Such national learning explains why the Internet emerged later in France than it did in other countries, yet emerged at a comparatively higher growth rate. We will develop this thesis using evidence primarily from e-commerce rather than from the global Internet economy because few data are available about the latter. The first part of the paper presents the status of the Internet in France and some details about its development. The second part of the paper analyzes what lessons we can draw from the Minitel experience.

1. National differences exist

The French delay

Regarding the internet, France developed early and noticeable initiatives. They were for their most part supported by administrative bodies and aimed at technical development, or academic and research support. One can mention, in particular, the cyclades computer network launched, in 1972, inspired by the Arpa project and run by the P &T administration for general purpose. Another case of such early initiatives is given by Renater, the national internet network for academics and research (Renater) developed on researchers initiative and giving an immediate, powerful and up-to-date internet infrastructure at disposal of french academics. Nevertheless, Academic literature, public reports, and comments from economic players frequently evoke the "French delay" in developing the Internet. Relative to other European countries and Canada, the penetration rate for PCs and Internet connections in France has long been low. As pointed out by Rallet (2001), in 1998 there were only 500 French retail Websites open to the public that had on-line sales capabilities, which is 2% of the worldwide total and less than 8% of the European total. These outlets' combined sales were only € 0.2 billion in 1998, which was only one-seventh the amount that the Minitel took in during the same period. In 2000, two years later, e-commerce sales were estimated, at € 6,098 billions for B2C1 - http://www.idc.fr), and, according sources, within a range from 0,380 to 0,900 M€ in B2B2.

In recent years, however, there has been a noticeable sense of urgency relating to Internet use and computerization in France. Since 1999, France began to catch up with its European partners: that year, the Internet in France grew 60%, compared with an average growth of 41% in other European Union nations. According to figures published by Jupiter

1 source IDC http://www.idc.fr

2 sources Forrester http://www.forrester.com, Benchmark http://www.journaldunet.com, Jupiter MMXI http://www.jup.com/home.jsp, IDC http://www.idc.fr ; Mediangles http://www.csa.fr/html/etude.htm.

MMXI Europe, France had nearly eight million home Internet users as of February 2001. This penetration represents a growth rate of 16% from the end of 2000. During this same period, growth in home-based Internet usage was 5% in Germany and 6% in Great Britain. Despite the stagnant growth level, growth of households online was still 14.1% in France (vs. 9.3% in Great Britain and 5.6% in Germany) from January to June 2001, according to NetValue. This sustained growth rate has made France one of the largest European markets for the Internet. French In 2000, more than 10% of French citizens used the Internet regularly. By comparison, less than 10% of French citizens regularly purchase national daily newspapers and only a few percent see films regularly[3]. In other countries, the Internet penetration rate at the end of 1999 ranged from approximately 15% in Germany and Japan to 24% in the United Kingdom and more than 40% in the United States[4].

This same pattern of an initial delay followed by increased growth also occurred in the business world: although only 28% of industrial concerns were connected to the Internet in 1997, the number had risen to 69% in 1999. Table 1 shows that among these firms, large corporations, for obvious reasons (readily available means and expertise, information systems needs, and business-to-business relations), were the forerunners, (with three-quarters of them already connected to the Internet in 1997 and 97% currently connected. It is probably even more interesting, however, to observe the situation within smaller companies. 88% of companies with 100 to 249 employees are now connected, which is twice the rate in 1999. For small companies (20 to 49 employees), the rate has tripled, reaching nearly 60%. This phenomenon can be seen in all industrial sectors, especially the "traditional" sectors, which were not widely computerized until recently. In fact, as Tables 2 and 3 show, the number of

[3] Cf. Mediangles (1999).

[4] These figures give an idea of an order of magnitude but do not enable a direct comparison, since these data constitute an estimate and come from a variety of sources using diverse methodologies.

companies in the machine, textile, metalworking, wood/paper, and clothing/leather sectors has grown quickly.

French industry and services in ICT[5]

In the French ICT sector, industry and services are of comparable economic significance, despite that services comprise 53% of total sales and 57% of jobs in this sector (see Table 4). In 1998, ICT industrial businesses realized overall total sales of € 56 billions, while ICT services had € 61 billions in sales. The industrial sector employs approximately 270,000 persons (as many as the automobile sector does), while the service sector employs approximately 400,000. Jobs in the latter sector require a much higher skill level than do jobs in the industry as a whole. Executives have 32% of these jobs, workers have 31%, and intermediary professions (i.e. technicians and first-line supervisors), have 2%.

The ICT sector in France covers four areas. Two of these area are information technology and telecommunications including both industry and services. The third field, electronics, is specifically industrial, and the last, the audiovisual sector, is essentially service-oriented. Table 4 shows that, among ICT services, telecommunication services predominate in terms of sales revenue (47%) and jobs (48%). Information technology services has 34% of total revenue and 41% of the jobs, while the audiovisual sector has 19% of total revenue and 11% of the jobs. In the telecommunications sector, services are particularly predominant, with total sales of € 29 billions (as compared with € 20 billions in industry) and 190,000 persons employed, or more than twice as many as are in the telecommunications industry. In the information technology sector, services (e.g., software, data processing, and maintenance) also predominate, with total revenue of € 21 billions in 1998, as compared with € 14 billions for industry.

Along with this spectacular development in the service sector, ICT is providing other

5 Most of the data in the following section are taken from SESSI (2000) *L'industrie française des technologies de l'information et de la communication en chiffres*

sectors of the French economy with new growth opportunities. Indeed, the development of this sector consists of the massive production of items that are used by most sectors of the French economy. It is not surprising that the information and communication technology sector contributes to the overall productivity of the economy, as outlined in the first chapter of this book.

France is the eighth-largest exporter of ICT products in the world, an average performance. Yet, the results are particularly noteworthy in the telecommunications industry, which is one of the strongest areas of French manufacturing and French international trade. This sector has been very successful in the last few years (cf. Table 5), and its contribution to the trade balance of France with other countries is considerable: more than € 5 billions, even as trade, particularly with the United States and Japan, has increased significantly, and despite the worldwide downturn in the Internet economy. The French telecommunications industry is relatively concentrated: 18 large companies (those with more than 500 employees) represent 9% of the total number of companies in the sector, but employ 81% of workers, realize 90% of total sales and 95% of exports and account for 91% of investments in equipment. The export rate (exports/total sales) is 55.8% in these companies, while it remains lower than 20% for small/medium-sized industries (SMIs, having less than 500 employees). Conversely, small companies with fewer than 20 employees only produce 4% of the total sales for the ICT sector, as compared with 8% for the manufacturing sector as a whole.

Until the year 2000, growth in the world market for telecommunications equipment was supported by growth in equipment and services for mobile networks. It was also stimulated by data transmission and networking. The European market, for its part, was rapidly expanding because of fewer constraints on competition, which resulted in a proliferation of infrastructures and the democratization of the mobile phone. Because of its

late start, the average annual growth rate of the French market is, at 42%, higher than that of most other European and worldwide markets.

In France, the mobile terminals segment is now the largest, but French industry is also well positioned in the communications equipment segment because the growth of the market for mobiles required cellular phones but also infrastructure equipments. This market includes interface equipment (modems, repeaters, multiplexers and amplifiers) and is profiting from the development of the Internet and from the proliferation of transmission media (fiber optics in particular). The telecommunications techniques that were once reserved for academics and defense are spreading very rapidly This expansion explains why French companies are increasing their sales, particularly their exports. Production outlets are located primarily, but not exclusively, within the European partners (cf. Table 6). The deregulation of telecommunications services in the European Union, which went into effect on 1 January 1998, and the proliferation of television channels and radio stations have fuelled the business equipment market. Moreover, emerging countries, such as South Africa, Mexico, and Central and Eastern European nations, are becoming choice market outlets as they modernize their infrastructures and develop their telecommunications networks. As a result, the telecommunications field has the largest share of the French trade surplus.

The telecommunications sector in France is dominated by four large groups: Alcatel (one of the world leaders in consumer telephony, along with the Scandinavian companies, Nokia and Ericsson), Thomson, Matra (oriented more toward business communications and defense), and Sagem. In order to fund the high level of investment required for development in this sector (these firms allot € 1.4 billion per year to R&D), companies must achieve critical mass. Substantial levels of corporate integration are occurring at both the national and worldwide levels. Firms are forging alliances in order to exploit a technology and quickly achieve low costs or to penetrate a promising market segment. Alcatel thus made up for its

late start in the consumer mobile telephony segment by negotiating license exchange agreements with Motorola, and it bought Newbridge, a Canadian company, to strengthen its position in high-bandwidth transmission in North America. To ensure progress in R&D, telecommunications firms are now among the largest French employers of management-level staff: since the capacity for innovation is key to corporate development, these companies are hiring increasing numbers of engineers, researchers, and other highly qualified workers.

Companies are also streamlining their production by not performing certain activities or increasing their use of subcontracting. Alcatel, for example, which is a non-specialized company, is liquidating certain activities such as cables and components, standardizing its production, and subcontracting its lower-value-added activities (e.g., the manufacture of its mobile terminals, which have become consumer electronics products), thereby reducing the number of its factories. This subcontracting trend favors small/medium-sized industries specializing in equipment assembly or installation. Relative to their larger counterparts, SMIs have less-skilled personnel (workers, operators, and technicians), do less research, and are less profitable.

The situation in the information technology sector is slightly different: it includes activities in which both manufacturing and services co-exist. French production is oriented toward complex products, such as large IT systems intended for large corporations, even though French firms also manufacture a significant number of personal computers. This sector is very concentrated (cf. Table 7). Although companies with fewer than 20 employees account for 82.9% of the businesses in this sector, they employ only 4.2% of the total number of employees and mainly assemble and install personal computers and perform wiring and maintenance functions. Because of corporate restructuring6, concentration is high and few firms dominate this sector :subsidiaries of two American firms (IBM and Hewlett-Packard)

6 Restructuring reduced staffing by 20% between 1990 and 1998 !

and the French company, Bull. Faced with competition from abroad for standard products, especially from Asia, firms in this sector are refocusing their activities on three key sectors: software production, technology services, and sales. They have also formed partnerships: after six software manufacturing companies were acquired in 1998, IBM entered into joint ventures with Dell, Bull joined forces with Microsoft, and Siemens teamed up with the Japanese company, Fujitsu.

Firms in this sector invest 15.7% of added value in R&D, a rate that is double of the average of other French industries. For the same reason, the employment structure in this sector is distinct from most other French industries: most personnel are executive staff or researchers. Workers represent barely 10% of personnel, as compared with almost 50% in other industries.

The French components sector is also expanding rapidly. This growth can be explained in part by the vitality of the telephone market and by the development of embedded electronics in the automobile sector. French manufacturers, which are the leading players in the field of smart (microprocessor) cards, have also profited greatly from the development of this market and are eager to broaden the field of applications into electronic commerce, management, and secure access. This passive component sector is made up, for the most part, of SMIs, which are responsible for nearly 50% of total sales, while they account for only 20% of sales in the active component sector. This industry is labor-intensive (20.7% of unskilled workers), which is characteristic of sectors in which there is a significant amount of subcontracting. Conversely, industrial groups predominate in the active component[3] sector, in which employees are highly skilled and large investments are required to fit out semiconductor plants.

A recurrent development model

When it comes to new technologies, the pattern of development we have described is part of a long French tradition. France perceives itself as a world leader in terms of technology, however, and the perception of a delay, whether accurate or not, has always stirred public opinion and motivated those in positions of power to promote new technologies and develop catch-up strategies by organizing projects, visits, and business trips for industrialists and decision-makers to the US. The same trends occurred during the 1960s when continuous production techniques and enterprise information techniques were developed, during the 1970s and 80s, when automated manufacturing was developed and the success of the Japanese industrial model was touted, and during the 1990s, when information technologies were developed.

Within this fairly general framework, the new economy has some special characteristics. In fact, there are several possible reasons why the French experience is unique.

The evolution of the entrepreneurial spirit in France

Until the 1980s, "the company," especially the small- or medium-sized company, was not viewed as important in France. There were several origins for this perspective— inertia in the higher levels of the civil service, the mercantilist tradition (handed down from Louis XIV's minister Colbert in the 17th century), and the high regard for public activity, especially as part of the post- World War II efforts lead by the state to make France into an industrial and technological leader. Conversely, the end of the 1990s saw increased emphasis of the entrepreneurial spirit, particularly regarding the new economy. This shift induced changes in how the French government intervened in the economy and fostered the emergence of financing structures (such as venture capital and innovation aid) that had previously encountered a great deal of opposition.

The entrepreneurial tradition in France is weak, despite public officials' regular attempts to shore it up by supporting small- and medium-sized industries, innovation, business start-ups, etc. Several factors might explain this paradox:

- sector idiosyncrasies and growth that occurs too rapidly for public bodies to react;
- a greater emphasis on deregulation, which requires new tools for public action;
- growing liberalization of the telecommunication sector;

focusing intervention on modernizing administrative procedures and support activities (promotion, training, and information) rather than on traditionally "French" forms of industrial policy" (Cohen, 1992).

The emergence of the Internet has fostered the proliferation of new initiatives. About 250 start-ups were financed in 1999, and more than 8,000 new companies have been formed annually in the ICT and Telecom sectors (Table 8). Most of these firms sell telecommunication services and data processing. The average annual growth rate of telecommunication services since 1996 has been 85%, and this sector has been stimulated by deregulation. In computer service activities, the average annual growth rate has been only 6%. Nonetheless, new firms have capitalized on opportunities associated with data processing, information systems, the transition to the Euro, and Y2K compliance. The financial and economic evolution these firms brought about (e.g., new capital investment, IPOs, and innovation in capital investment and venture capital) have resulted in structural changes to entrepreneurship in more traditional industries.

The availability and importance of means of financing and capitalization

These developments have also led to increasingly sophisticated forms of financing and capitalization for new firms. There is more segmentation and hierarchy among forms of financing: new financial intermediaries, friends and family, venture capital, and investment

funds). Firms such as the Bernard Arnault group, Dassault, and Andersen Consulting have funds designed to secure a foothold on the Internet or guard their traditional markets. Audiovisual and telecom companies (Vivendi, France Telecom, and Sagem) are anxious to sell their services to new innovative enterprises. Banking organizations, insurance companies, and the new financial service providers (Morgan, Rothschild Finance, Lazard-Axa, Galileo, and ABN Amro), along with "opportunistic" investors, small investors, and mutually funds are eager to take advantage of strong growth opportunities. As a result, available funds (three billion euros +/-15% in 1999) for investment capital increased sharply. In 1999, venture capital funds (42) invested nearly € 6.2 millions, on average, for an overall total of € 427 millions (up 64% from 1998) in Internet firms. Venture capital firms that previously focused on innovation (Sofinnova, Innovacom, CDC Innovation, and Axa Innovation) were among the most active investors. There were, however, comparatively few IPOs: only about 30 initial public offerings occurred in 1999, and the number of listed companies was only 113 at the end of 1999. The recent stock market crisis has further reduced the number of IPOs. Clearly, French firms have preferred other forms of financing to IPOs.

In contrast, large and medium-sized existing companies that were expanding onto the Internet (platforms, Websites, intranets, Web portals etc.) generally used equity capital to finance these activities. The private nature of these investments and the lack of available data about them make it difficult to assess the extent to which self-financing was used. This phenomenon is probably related to the relatively important role played very early on by business-to-business exchanges in Europe, compared to the US, according to a study published by ActivMedia in 2000. Although nearly half the websites in North America and the Asia-Pacific region cater to consumers, only one in four European sites and one in three sites in other countries do. Half of European websites are B-to-B, as are just over a third of

North American sites, one in four Asia-Pacific sites, and nearly one in three sites in other parts of the world.

The role of national characteristics in the development of the Internet

The global convergence of communications and networking protocols has not prevented national differences in how consumers use the internet. This divergence is influenced by national cultural traditions. Not all types of content are directly transferable from one means of communication to another, and the culture of each country affects how this content is adapted, assimilated, and adopted. Accordingly, IT penetration rates and usage patterns (i.e., professional/private use, preferred services, and how recently users were connected) differ from country to country (see Table 9).

In France, language has also probably hindered the entry of the larger American sites. In most other countries, including even other European nations, large international sites generate the most Internet traffic (Nielsen Netratings, 2001). In France, however, most sites with the highest rates of traffic are national sites. This trend holds both for general-interest sites, such as search engines or access portals, as well as for more specialized sites (e.g., travel services and on-line auction sites), for which national enterprises were able to establish niches early since they were among the first on the scene. In several instances, foreign participants (e.g., American, English, and German firms) successfully established a presence in France only by acquiring these successful national forerunners.

France Telecom had been able to adapt itself

Despite privatizing fairly late as compared with other operators (e.g., in England, Scandinavia, or Germany), France Telecom established a strong presence on the Internet. Wanadoo, its service provider subsidiary, is the most frequently visited French domain, with a 55% penetration rate and 4.5 million single visitors (one million more than its closest runner-up). There are a number of possible explanations for its success: its ability to establish a

strategic position and anticipate the transition to a competitive market (in terms of pricing, full-scale development campaigns, spin-offs or division into subsidiaries of certain activities, and negotiations with labor organizations), a considerable degree of integration of networks and services, a good public image, unique expertise in research and development, and financial capacity.

France Telecom was the prime example of the strong (past) presence of the State, and was characteristic of an engineering and professional culture coupled with a technical and research-based sense of legitimacy. The company underwent its first break-up in the 1980s, marking its evolution toward a private firm and the of the revision of its corporate raison d'être to a focus on customer service). By favoring new entrants under the guise of the deregulation of telecoms and mobile phone providers, the French regulatory association indirectly caused France Telecom to become more sales-oriented as it anticipated changes in its competitive environment, notably with regard to the Internet. This cultural transformation, carried out via a series of reforms, was brutal in many ways. Moreover, as we will see in the second section, the technical skills that were built and the experience that was gained through developing the Minitel created an expertise and knowledge of networks that could be quickly mobilized for later Internet developments (see below).

Monopoly and barriers to entry

We see in several chapters to this book that access to the telecommunication infrastructure is a critical factor influencing the expansion of the internet. The Swedish study points to the importance of “pockets of competition” that were able to play the role of a Trojan horse, allowing for competitive access to the infrastructure. De-regulation was fundamental to the US, UK, and eventually Japanese and Korean cases. What has been the case in France?

The standard thesis emphasizes that the France Telecom's former monopoly status slowed the development of Internet networks and services in France (Bomsel and Leblanc, 2000). Our qualitative studies show that the key period in which the awareness of the professionals that were to launch internet-based businesses occured in the period 1996-1998. In France at the time, the number of internet users as a percentage of total population was lagging behind most european countries (Table 10), and the number of internet hosts per 100 inhabitants was lagging even more (Table 11). Before arguing for a French delay based on Telco monopoly, it must be noted however than france was also lagging (though less) in PC penetration rates in homes, which rose from 10% in 1993 to 20% in 1997, compared to the case of germany for which it rose from 13% to 26 %. The latter figure provides a constraint to the development of the internet audience in france which is largely independent of monopolistic tendencies in telecommunication policies (Table 12). The issue is better discussed if one looks at R&D and firm policies at the same time.

Several plausible arguments support the thesis of the retarding effects of a monopolistic and state-owned telecommunications carrier. On the technical side, France Telecom's R&D labs were still promoting ATM protocols over Internet protocols for data packet transmission well into the 1990s. On the managerial side, most of French Telecom's managers were engineers who belonged to the elite administrative corps that composed the top ranks of French administration. Also, the multiplicity of career bridges through the top levels of the French public service ensured strong couplings and influence networks for France Telecom within the French state, and provided it with the political clout to affect decisions relevant to its interests, when those were well defined.

France Telecom also wished to preserve the profits it derived from both the Minitel and its telecommunication services. As a monopoly, it was able to charge high prices for landline phone calls. These prices have probably slowed the penetration of the Internet in

France. Studies of lead domestic Internet users experimenting with ADSL access in 1998 showed that most of them were very cost-sensitive, and that they wished to have flat rate billing[7]. Also, commuted access "(traditional connexion through switched telephone network)" is likely to remain the dominant form of connection for the next few years since high-speed networks (cable, ADSL) are diffusing slowly.

Today, there are two different economic and technical models for commuted access. For a direct interconnection, the user is invoiced by France Télécom. For an indirect interconnection, the user is invoiced by a telecom supplier, by an access provider, or by France Télécom. The service provider charges either a flat rate fee or a fee that is based on the time the user is connected. As competition has increased during the last two years, suppliers have developed sophisticated pricing offers. Some in France have explained that it is difficult to implement and provide unlimited commuted access to the Internet so long as Internet penetration and connection level remain low in France. Although a few suppliers tried to offer unlimited commuted access, they had to suspend these offers after a few months because their own connection costs, which still depend on the number of user connections and the time that users stayed on-line, increased. Moreover, these providers had technical problems since their equipment could not handle the new subscribers' high demand. Several operators and access suppliers pressured the national Authority regulation to require France Telecom to supply a global interconnection for a flat rate so that they could provide unlimited access and still make money.

We believe, however, that France Telecom's monopoly status provides only a partial explanation for the delays we have described. In the mid 1990s, French civil servants and entrepreneurs were blind to the possibilities prevented by the Internet. The three main public reports of the time scarcely mention the Internet. (The Thery report on information superhighways, the Breton report on teleservices, and the AFTEL report on the future of

7 cf. Beaudoin (1999).

telematics.) It is possible that the interests of the Minitel service providers were aligned with those of France Telecom because of the peculiarities of the Minitel billing system (the *kiosque multimedia*): consumers paid for using the Minitel services through their phone bills, and France Telecom gave back part of that money to the service providers. Yet, according to consulting and engineering firms trying to sell web sites to French firms in 1995, officials from the public sector were utterly unaware of the existence of the Internet and of the potential of Web services[8]. That situation began to change from 1996 to 1998 due to several initiatives, which included state reports and private sector efforts that targeted France's need catch up with the US in developing Web-based services. Examples include the Yolin report, which stressed small French firms were lagging in developing advanced Internet services, and the Lorentz report on e-commerce, appearing in 1997 and 1998, respectively. Among private sector efforts, one needs to mention the "Atelier de la Compagnie Bancaire", under the aegis of Jean Michel Billaut, self-proclaimed French guru of the Web, who enlightened prospective French electronic entrepreneurs about the latest trends in Web experiences. We believe that this ignorance of the Internet in France was largely a byproduct of the tight bonds that linked influential individuals from the public and private sector into a collective network.

Moreover, arguments that highlight monopolistic effects conceal the deep transition that occurred in the 1990s in France Telecom. The same men who had been civil servants within the French telecommunication administration quickly became the staunchest defendants of the private sector over a few months in the mid 1990's. Various kinds of hybrid organizational forms supported that move. First, although France Telecom did not have private sector contracts, it was largely separate from the civil service (this separation was legal so long as the state remained the absolute majority shareholder in France Telecom). France Telecom thus spanned the public and the private sector. Beginning in the late 1990s France Telecom also began developing subsidiaries (the latest of which is the Orange group)

8 This finding appears in current series of interviews performed independently by both authors.

in France and abroad that had private sector contracts. In some of these subsidiaries, such as the Internet access oriented Wanadoo, a distinct ethos emerged among the founders that combined elements pertaining both to the spirit of startups and the practices of the larger structure. Such evolution led to the development of new hybrid career paths for key actors.

Secondly, the coexistence of public and private interests relied on some interfering practices, such as the accounting procedures for this growing halo of firms around France Telecom. Also, R&D outputs have been gradually defined, with much fanfare, to emphasize marketing and services development that is helping to unite the large R&D force and the marketing organization. The rhetoric of services became pervasive in the late 90s, in part replacing, in part supplementing a more traditional focus on networks and infrastructures.

To put it provocatively, it is essential not to reduce the French trajectory to the negative effects of the State and the interplay of public sector and monopolistic practices. It is instead important to understand how the complex networks that supported a mostly public organization until the mid 1990s could evolve into a mostly private one in the early 2000s, and how the former public and monopolistic system that today's market advocates are so keen to criticize could also be construed positively as a resource for negotiating a complex transformation within a very risky international context.

Organizational learning take place for the various actors

In short, we argue that a detailed analysis casts more light and shade on the so-called French delay than might be expected. It is important to take into account, on the one hand, the Internet's late takeoff and its ensuing rapid growth rate, and, on the other hand, low penetration statistics that still reflect the initial time-lag and usage figures that show the diversity of situations and modes of appropriation, which are sometimes very intense for certain activities. The development of the Internet sheds light on a specific developmental mode for technology and related economic forms, one that operates continually, even as

exchanges are being displaced and transformed, without being leveled-out by technology. This specific form of development and adaptation is central to the interpretations that are suggested by the learning experiences and successive waves of technological change outlined here. We will illustrate this point by describing the importance of the Minitel to the French experience. In France, the Minitel is still very relevant for operators and firms, particularly actors already present in distant retail, new entrants, operators, technology suppliers and services suppliers, and final users.

2. From the Minitel to the Internet

Establishing a chronology

As we pointed out in the introduction, the attempt to characterize Internet usage today and to place such usage in historical perspective is difficult because it is impossible to define precisely the systems and technologies in question. This usage depends on a modular technical base that combines various infrastructure components, autonomous applications, implicit organizational forms embedded in the technical configurations, and diverse procedures for use. Establishing even a simplified chronology of the transition from more basic forms of telecommunications (telematics) to the Internet perfectly illustrates the overlapping phenomenon of the various technological layers. It is thus particularly difficult to distinguish which developments stem from the creation of networks (beginning with packet switching), servers, protocols (from Videotex to HTML), and terminals (from the dedicated "Minitel" to the individual computer and the net box) from both the services provided and the related management and billing methods (e.g., the invention of kiosk-type billing services and subscriptions). Terms such as “Minitel” are inherently ambiguous because they lump together all these elements. We will attempt to be precise in our discussion below, while focusing on services and usage.

Without trying to isolate one single event, the origin of Minitel data communications (telematics) can be dated to the 1970s. As with the Internet in France, this origin involved a

late start that had to be overcome. At the time, observers believed this delay was related to both the level of installed telephone equipment and the state of the French computer industry, which was not very developed. The Minitel project was undertaken to address both issues: it let the industrialists and the telecommunications authorities[9] to further their efforts to update the French telephone system, and allowed these efforts to be oriented toward computer technologies.

There were several important technical trends and milestones in the Minitel's development. The core service was designed around a national electronic directory, provided at the expense of the operator; the planned method of consultation was based on a moderately priced dedicated terminal, which was supplied free-of-charge to all users in order to encourage its use. The service was also open to other applications. After an initial period of hostility from traditional media outlets that were wary of possible competition from this new information medium, the DGT (the Telecommunications Branch) was able to unite and to enter into numerous partnerships with private operators (the press, media, service, and information base providers). The Minitel was deployed gradually, and relied heavily on local experimentation; electronic messaging and forums constituted (along with the electronic directory) were the "*killer applications*" that strongly stimulated connections and the supply of new services.

Initially, the Minitel was economically viable because of its technical and service product offering. Its development rapidly leveled off, however, and was subsequently revived only by initiatives that focused on the organization of payments and on the remuneration of the various service providers. It was, in fact, the "kiosk" billing mode — invented by the DGT — that was responsible for the takeoff in the use of services by the general public. The kiosk offered a unique form of fee-for-service billing directly debited from the telephone account,

9 The DGT (Direction Générale des Télécommunications) was the public administrative body that became a state-owned company under the name of

with France Telecom being responsible for subsequently reimbursing their tolling revenues to the service providers. This system replaced the traditional telephone billing system based on call distance, which was not well suited to on-line services; it was also quite different from the subscription arrangements offered by some service providers, which met with little success because they required users to accumulate several subscriptions in order to access all the services they wished to use. The kiosk's success was astounding. As a means for accessing an increasingly diversified base of services and customers caused the billing system to evolve from a single billing system in the beginning to a differentiated "step variable" system (instituted in 1986).

Although the plan was initially limited to the Minitel, it was soon extended to certain telephone numbers (Audiotel). In this way, the DGT inaugurated a new era of telecommunication services by stimulating the provision of content, thanks to a new partnership model between the telecommunications administration and a diversified base of content providers that differed radically from the strictly monopolistic models. It offered content providers a profitable and simple economic model, which continues to be nostalgically evoked today, even by Internet participants. We should add that, since network development and the supply of terminals was largely, if not exclusively, As a state-subsidized venture, the Minitel reached its break-even point only in the mid 1990s.

Although the 1980s were the key years for the Minitel venture, the “information superhighway” rhetoric did not flourish until the 1990s, when the telecommunications sector was opened up to competition in France. Three reports, all of which appeared in 1994, represented this new rhetoric: one by Gérard Théry, the former director of the DGT, on the information superhighway, one by Thierry Breton on teleservices, and one on the progression of telematics toward the information superhighway, published by AFTEL, an association of

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France Telecom and was later privatized under the same name.

telematic professionals. The key word was digital convergence, and the belief was that wide-band networks would make it possible, with the digitizing and interoperability of services, to support an almost infinite range of applications. During this period, France Telecom, the successor to the DGT within the framework of deregulation, deployed long-term R&D initiatives to expand on the Minitel's success and to develop new value-added telecommunications media. At this time, the integrated services digital network (ISDN) was set up and the first electronic messaging services (using the X400 standard), electronic-mail services (Teletex) and an enriched facsimile system were launched. The Internet will eventually displace all of these services with platforms that integrate all forms of mediation around networks.

The success of the Minitel and the resultant attempts to expand its reach probably explain why the Internet was not viewed as important. It was alluded to only very belatedly, and only once in a public report (the Théry report in 1994), and then only to harshly criticize its lack of a simple billing system and its overly open and cooperative nature, which was thought unlikely to encourage the development of commercial services. Far from the perspective of open interconnection and distributed innovation that characterized the Internet and the Web as they were developed in the United States, the Breton report (1994) continued to advocate that the service offering should be adjusted to usage via large-scale experimentation, based on the Minitel model.

Most actors assumed the future telecommunications would continue along the lines of the Minitel experience. In this shared vision of the world, the perspectives and strategic challenges of the various economic operators seemed to converge. It is not surprising that France Telecom would be wary of embracing the Internet. It wished to preserve present and expected gains from Minitel that had finally reached its break-even point after paying off the heavy investments required to develop it. It should be noted, however, that the service

providers had just as many reservations: they worried about rushing headlong into a new system and preferred to preserve the hard-won gains they had obtained by constructing this large public market. France Telecom expressed these concerns through the intermediary of Aftel, their professional association.

As a consequence, both the number of Minitel terminals and yearly consultation times have decreased much more slowly than was projected since the Internet appeared (see Table 13). It is thus likely that the Minitel will be used a great deal for the next several years, since it is available to a wide audience, an important fraction of which has not yet gained access to the Internet or developed the skills to use it effectively. For these segments of the population, using the Minitel for banking or retailing services remains an attractive option. Indeed, the Minitel is offered as a for-fee service bundled with French versions of Microsoft's operating system pre-installed on some computers.

As we saw in the first part of this chapter, the transition toward the Internet began in France only at the end of the 1990s. Two public reports sum up this change in mentality particularly well: the first was the Yolin report, which appeared in 1997 and focused on the experiences of small- and medium-sized companies; the second was the Lorentz report, which appeared a year later. Both took up, once again, the theme of French delay, but emphasized the inadequate use of the Internet by French companies and society. The omnipresence of the Internet in this new wave of official reports is just as striking as the corresponding absence of the Minitel, which received only cursory treatment in the Lorentz report. This report also accorded prime importance to e-commerce, while the Breton report gave only passing mention to television shopping as but one of many types of telecommunications services. The re-emergence of the rhetoric of the French delay revealed that the Internet is widely perceived as exogenous to the French situation. At an elementary level, this rhetoric reflected the fact

that, once again, those responsible for French public policy had to turn to the United States as a source of new technology.

At another level, this language indicated that the Minitel and the Internet were not being developed in France as an integrated technical system as was, for example, electricity (Hughes, 1993). In fact, Internet protocols and services were not perceived as a possible response to problems and were not understood as such within the framework of the implementation and development of a telecommunications system. They seemed to come from somewhere else (Flichy, 1999) and were supported by other networks or sub-networks, other protocols and standards (Edwards, 1998), other service providers, other terminals and other operators, and had a different ideology (i.e., whether or not to bill for certain services, or the association of open systems and the interoperability of architectures with a libertarian bias).

The dominant interpretation of the French experience, from telematics to the Internet

The characterization of the Internet as an exogenous entity in a series of several significant official reports between 1985 and 2000 raises several questions.

The first question that widely captured the attention of French and foreign analysts is why telematics was so much more successful in France than it was in other countries, such as Great Britain and Germany (Cats and Jelassi, 1994). Castells addresses this question by proposing three reasons. First, the Minitel's success resulted from intervention by the state, which subsidized the network and terminals and thereby directly created the conditions for a large public market. This intervention was then strengthened by the public authorities' ability to develop the partnerships and billing structures that facilitated the deployment of a private system of content providers, which combined the efforts of traditional companies, software and IT services companies (SITS), and new "telematic" companies (Charon, 1987). Finally, this success was made possible by the fact that the construction of the Minitel system was

gradual, took advantage of the experience and ergonomics of prior projects (e.g., an aborted project to develop a facsimile system for the general public), and relied on a large number of experiments. By relying on public feedback regarding potential uses, the developers increased the probability that the general public would accept the Minitel. This acceptance was later reinforced by the kiosk fee-for-service billing system, which enhanced the Minitel's flexibility and ease of access. Ultimately, usage was anchored by offering services like the "rose-colored" lonely-hearts messaging system, which resonated deeply with many French people and created conditions favorable for a collective learning experience. It should be noted, moreover, that, beginning in the 1990s, these initial services (games and "rose-colored" services) began to decline in popularity while more "serious" services (various types of information, TV shopping, remote order-taking, etc.) became more widely used. It is interesting to note that Castells feels obliged to justify the later success of the Internet by highlighting how the Internet would resolve the problems inherent in Minitel telematics: exceedingly hierarchical network architectures that do not favor horizontal gateways, and the low intelligence levels of the terminals. Like many other writers, he starts by assuming that the Internet and its related services take similar forms in all European countries, and feels he must simultaneously explain the phenomenal success of the Minitel in France and its apparent disappearance in a wave of cultural leveling at the European level.

A statement that contends a country-wide learning effect existed must be given another interpretation since differences in both substance and form exist between the Minitel and the Internet (e.g., billing methods, ways of acquiring the terminal, and public policy development and the status of operators, with France Telecom moving from a monopoly position to a competitive relationship with its former suppliers).

This perspective entails a post hoc interpretation of these effects. On the one hand, reports dating from the middle of the 1990s identify limitations in the use of the Minitel and

the Videotex for home shopping (such as the difficulty of producing a description of the products). There is, however, no immediate resolution proposed in these reports. The tentative solutions that are advanced rely on TV shopping and interactive television, and do not refer at all to HTML interfaces (Breton, 1994). Further, the Internet did not develop in France as response to the Minitel's problems, nor—as we noted above—has it caused this medium to disappear. Even though the Minitel has declined in popularity, it still realizes five to ten times more sales (depending on the sector) than the Internet does for e-commerce services intended for the general public. Certain Internet-oriented companies continue to open Minitel servers, even though their consultants advise them not to advertise the fact. The coexistence of these two media has, however, led almost all of the multimedia participants to contrast the Minitel, which they categorize as essentially an ordering system, to the Web, which they regard as a true sales and marketing tool.[10] This framework is the basis for interpretations that are similar to Castells'. By framing the Internet as the successor to the Minitel, actors view the former as a response or solution to the limitations of the latter. Thus, for instance, the ease with which HTML interfaces can manage detailed product descriptions and promotional and marketing materials can thus appear to be a response to the limited resources of the Minitel screens. HTML interfaces are then considered to be the prototype of the functional interface par excellence. Incidentally, present-day critics who decry the lack of user-friendliness of WAP screens on mobile phone terminals repeatedly compare these screens to Minitel screens.

This framework of technical evolution is quite deterministic. To resist it, we must abandon the idea that a higher-performance technology has replaced a precursor system that is limited in scope and, based on experiential knowledge, to assume that the French telematic experience produced specific effects. At any rate, we believe the most interesting and difficult question is quite different: how does one identify, within the telematic experience, the effects

10 Interviews were conducted in an on-the-job setting.

of formatting, continuity, and learning that influenced how the various operators in France, whether they were directly or indirectly involved in the telematic world, appropriated Internet technologies and services?

Clearly identifiable transfer ranges and learning effects

In order to identify the characteristics that the Minitel and the Internet share, we consider two levels of analysis, and two particular examples, that focus on the operators that provide e-commerce services to the general public on the Internet.

Research and development by France Telecom

Mastery and control of technological resources are crucial, but often overlooked when sites are developed. Labor markets for engineers, technicians' capacity to master technology, interoperability, databases, hosting, maintenance, and new application development are all strategic considerations. Given the importance of these resources, it is important to assess the extent to which the development of the Internet relied on both the technical expertise developed and the research conducted for the Minitel. Regarding the latter[11], the historic operator's research center was directly involved[12]. Telematic research was split up into several different units and allocated to three different locations: the Lannion center in Brittany dealt mainly with network questions; the Rennes center concentrated on interfaces and telematic services (e.g., the development of the electronic directory); and the Caen center specialized in the services related to the postal interface and value-added networks (electronic mail, facsimile, finance, and security).

As reflected in the major reports of this period, researchers at the CNET found the telematic framework confining, as they attempted to take into account the deployment of

11 This section is based on a series of preliminary interviews, at a historical research centre, with the participants in the telematic experience at the C.N.E.T, conducted by one of the author (C.L.).

12 In the middle of the 1990s, at the time when deregulation of the sector transformed the former DGT into the historic operator now called France Telecom, it was still known as the National Centre for Telecommunications studies (CNET).

Internet protocols in America. At Lannion, the attitude of neglect regarding Internet-related issues centered on a discussion of protocols and standards for future networks. For the most part, the center defended solutions based on the ATM standards (*La Recherche*, 2000). At Rennes, the center was aware of the limitations of the Minitel interfaces, but it focused on the deployment of more elaborate interfaces, with its sights on the PC operating systems of the period. According to the first-hand accounts of participants at the time, these efforts ran up against the lethargy of the terminal manufacturers, which were not inclined to develop more advanced terminals since the current arrangement with the operator was already very profitable for them. One visible sign of the research centers' lack of sensitivity to new services and of their Minitel bias is evidenced by the following development: when the CNET decided to launch Internet plans in the second half of the 1990s, its management decided, in principle, to concentrate efforts in the center located at Caen, which until then had been the least involved with the Minitel.

At first view, these developments confirm the argument that the deployment of the Internet was checked by a lack of vision and blocked by actors who had interests in telematics, and that the slate needed to be wiped clean of past telematic experiences. Nevertheless, the experience of the Rennes center and its later evolution suggest other interpretations. In fact, this center had developed a high level of competence in Internet services in just a few years and was radically repositioning itself at the beginning of 2000. By developing more specifically-targeted efforts to interface Minitel screens with PC screens in a manner that accounted for digital convergence, the Rennes center gradually oriented its research toward hypermedia languages. It focused especially on developing dynamic editors, which enable the automatic updating of data and methods-oriented interfaces on any platform ("Edit once, publish many times."). Today, these concerns are viewed as one of the most important problems of multimedia design. The competence of the research center in the areas

of language translation and the portability of information, services, and interfaces to all types of platforms clearly benefited from the prior learning experiences provided by telematics. By taking advantage of these learning experiences, the Rennes center was able to preserve some space for Internet research with the historic operator.

It is important to point out that this use of technical skills that were initially developed for the Minitel in developing the Internet occurred not only in R&D departments but also in the operational units of France Telecom. In fact, in the second half of the 1990s, a single unit, the Multimedia division of the branch devoted to the general public, was responsible both for Minitel telematics and Internet services. One could reasonably conclude that this division put the experience developed by the DGT with the Minitel to good use in terms of the dialogue it created and the partnerships it built with private content providers. This experience made it possible to put together a framework and skills base that could be used to design and implement the operator's Internet activities. It explains, to a large extent, the rapid transition described earlier.

Analogous learning experiences also occurred at other operational levels. For example, more than half of France Telecom’s sales by its Internet subsidiaries (Wanadoo S.A., founded in 2000) comes from the Yellow Pages, which is an area of expertise falling under directory services. This expertise had been transposed to the Minitel very early on in the form of the electronic directory, the development of which in fact was viewed as a valuable resource that would help make the Minitel profitable. Beginning in the 1980s, the development of this directory led France Telecom to construct, develop, and mobilize its competence in the area of languages and databases, including the capability of deploying them and transporting them to different platforms (Minitel, local networks, and various IT standards). Transporting this electronic directory to the Internet was thus only a problem of setting up a new platform and did not require France Telecom to design the service from scratch. France Telecom was thus

able to set the directory up very quickly, and it very rapidly increased Internet usage. It would appear that the same learning effect influenced the management of the marketing side of these directory solutions, which could, for the most part, be re-used for the Internet (partnerships with advertisers, fee structure, customer follow-up, and so on.

Consumer e-commerce market

A second example of the relationship of the Minitel to the Internet is in the consumer space. As noted earlier, information systems can be characterized as much by their technical components as by the implicit organizational models that they represent. It is particularly interesting to note that the learning curve provided by the Minitel also operated at this second level. It is therefore possible to identify transfers of experience and solutions from the Minitel to the Internet that prefigure the widespread use of certain models that are now found everywhere on the Internet. Such transfers are especially noteworthy for how they are used to diversify and cross-fertilize markets, for their capacity to manage multichannel processing (the Minitel, fax, telephone, and telex) and for their application in business models that take into account the constraints related to multiplicity and the appropriate allocation of transactions and billings (i.e., the kiosk model). This learning curve affects not only the historic operator but also all of the economic participants that participated in the Minitel venture (technology providers, service companies, content creators, and the like). To illustrate this point, we will analyze the effects of this learning experience for the strategies and operating modes of market participants, especially participants in e-business to consumers (B2C). This section is based on fieldwork systematically conducted over 18 months with retail operators on the Internet, which were questioned about the links between their experience and the various aspects of telematics. We will distinguish between two types of participants: the true new entrants on the Internet scene (the "pure players") and the service providers that have already acquired sales experience on the Minitel and telematic servers.

Generally speaking, vis-à-vis e-business, strategies typically developed by French firms are very cautious. “Brick and mortar” firms in France are very skeptical about the ability of e-business to rapidly capture significant market share with the general public; such firms believe their experience of selling via the Minitel distinguishes them from the Internet neophytes. The evidence for this contrast is particularly clear-cut in the ergonomics of the services offered on the Internet. Toward the end of the 1990s, American Web designers developed a rhetoric of the commercial Website as a genre by contrasting it with two "foil" models. The first model concerns sites that contain essentially written text (thereby too closely resembling print formats); in the second model, the designers allow themselves to be carried away with technical feats, constructing highly animated sites that "flicker and flash all over the place" but are very difficult to load, even with the state-of-the-art equipment that is now available to the general public. From the perspective of several Minitel service providers that recounted their approach to the Websites they had set up, the American sites exhibited the latter shortcoming: an excess of multimedia. French companies with Minitel experience feel, on the contrary, that they must try to profit from their mass-market experience by offering sites or design elements that retain the functional and graphic simplicity of the Minitel. These firms believe such simplicity is essential to capturing significant market share.

As an example of this attitude, a large on-line travel agency, which was the offshoot of a telematic holding company at the outset, put its principles into practice by setting up its site on the basis of two different ergonomic styles. The first offers an extremely simplified area, whose simplicity is based on the lessons drawn from the Minitel experience. By its side is a more difficult-to-use version, which uses search engines, for example, to call up requests, and which is more "Internet-oriented", according to the site managers. It has two distinct usage formats that are layered one on top of another: inside what appears to be a typical Web screen, the site offers a quasi-specific reference to the Minitel – but it has been re-appropriated and

re-invested with Web-type formats to such an extent that the reference becomes almost imperceptible.

Second, numerous operators with past telematic experience in on-line commerce insist on trivializing the Web. According to them, it offers nothing really new; it is just another sales channel that offers a concrete example of expertise in remote sales that they feel they already possess because of their Minitel experience. The correlate of this perspective of e-business is that these operators insist on creating a shared base of specific knowledge and skills, which they use to develop diversified sales platforms. Moreover, in the background of the customer relationship, they strive to construct a back office and, to the extent possible, a middleware common to all of the various distribution channels. Many pursue this goal even when doing so creates a surprising degree of heterogeneity; for example, the Internet site of a specialized distributor was only just being connected, in 1999, to an AS400 networked system shared by the telephone and Minitel ordering channels. Indeed, databases, products, and customers are the focus of this resource-sharing process, rather than the communication technologies themselves. These databases are thereby organized in terms of descriptive traits, categories, reference numbers, and structure, in order to be able to feed each channel. This preoccupation is ubiquitous with former telematic participants, but some new entrants share it as well, especially if they arrived early on the Internet scene prior to 1998. This tendency also appears to be reinforced by the opportunities created by the new mobile telephony services (WAP and UMTS), which are opening up opportunities for a multiplicity of future distribution channels. Another specialized distributor had its Website constructed by a Web agency that initially specialized in telematics: this site was set up so that a single database could simultaneously feed an Internet site and a "phantom" Minitel site, one of the functions of which was to test the overall coherence of this system. For another client, the database produced for the Minitel

was simply expanded with new fields, enabling it to adjust to accommodate the capacity to include images of the product, something that is possible on Internet sites.

One can see how this successive expansion of a database exemplifies the comparison between the Minitel as an ordering channel and the Internet as a sales channel, for which product description can be enriched with descriptive multimedia formats. The database is a device based upon methods for comparing and evaluating these two forms of service. As a consequence, structure of databases are different according to how categories of services are defined therein. Certain traits and application tools are either included or excluded in the construction and use of the database : in some cases, databases may be, for instance, invisible, embedded in information systems, incorporated in network and services policy (Bowker and Star, 1999).

Returning to the initial question, the experience of the former participants in telematic ventures tends to push them to pursue increased interoperability, portability, and fluidity of the information systems working in the background of the customer interfaces. This concern with interoperability is widely found in their discourse, if not in their actions. These concerns, which are the offshoots of their experience, are for the most part not evident to the user.

There is a second issue that is central to the development of e-commerce. It involves the capacity for redistributing the transaction itself over several platforms and media. The experience of the call centers of a large shipper illustrates the significance of this issue. This firm's managers have stated that they learned from the Minitel experience that it is important to have dedicated phone lines so that information or advice regarding the transaction can be provided via this channel. This example of an early learning experience concerning the processing and consideration of a request resulted from the company's past experience with

Minitel callers. This learning experience not only contributed to creating an awareness, in the shipping company, of the need to provide a similar link between the on-line sales site on the Internet and the call center; it also made the managers aware of the difficulties generated on the Minitel by their past hesitancy to equip the call center operators with a terminal and telematic access. When they made the transition to e-commerce via the Internet, these managers were thus more easily inclined to quickly equip their operators with Internet access stations. This point is important, and it has been confirmed by a number of firms that engage in on-line sales. For the telephone operators dealing with Internet users, the capacity to consult the electronic platform (if possible, during the call from the Internet user) is indispensable for establishing and confirming a common reference point with the customer. This shared framework is an absolute prerequisite for enabling the parties to establish a basis for agreement concerning the transaction. Here again, the Minitel learning experience is hidden from view, but it has enabled French Internet companies to speed up the introduction of electronic Internet access in call centers.

Conclusion

By searching for common elements between the telematic experience and the implementation of Internet and commercial on-line services, we have identified a body of effects related to both the interoperability of formats and the simultaneous management and distribution of interactions over several platforms. The telematic experience thus provided us with a number of concrete examples of the capacity to combine and use several different formats for interaction. We can speak of capacity inasmuch as the nature of this learning experience makes conceivable, and directly structures, a body of knowledge that can then be exploited to increase the number of technical broadcast channels and to combine and manage the numerous and diversified platforms and exchange formats. This orientation of the

cognitive economy of the participants – and the configuration of software technologies on which it is based – is at the heart of the philosophy of networks to such an extent that it is difficult to objectify and measure. Indeed, how do we account for what is only a tendency to integrate a more distributed and spread-out commercial relationship? Can it be reduced to a concern and a set of skills that can be mobilized in other contexts of networked technologies in order to share databases and make formats and languages interoperable? Do these properties underlie the ability to simultaneously integrate a more distributed commercial relationship?

These findings prevent us from rejecting the thesis proposed by Castells that the limits of the telematic experience explain, once and for all, its replacement by services based on Internet protocols. The model underlying the description that we have given of the telematic "late start" in fact operates by two stages. We first observed the neglect of the Internet's potential for exploiting the profitability of a new and difficult mass market. We then noticed that the rapid appropriation of the Internet was based on expertise acquired within the telematic framework, and allowed a variety of informational formats and the corresponding distribution of interactions to be co-managed over different platforms. The limits of telematic services that some have pointed out, and the idea that the Internet could provide a solution for them, essentially stemmed from post hoc perspective that has been constructed during a time when both types of service.

The task of simultaneously reinterpreting the past and contrasting its different types of technologies is never-ending. The challenge of providing economically viable on-line services for a mass market is, from this perspective, plagued with the same tensions and unresolved arguments. For example, it is not clear if a service should be provided free of charge or, if there should be a fee, which billing method should be used. The rise of successful services based on fee-for-service billing methods (i.e., based on the quantity of data exchanged) thus

leads French observers, analysts, and professionals to recall fondly the telematic experience and to advocate the implementation of business models tested on the Minitel: the kiosk-type billing model is thus suddenly regarded as a panacea for an entire class of unresolved economic problems[13]. This appropriation of the Minitel business model by Internet service providers is an ironic but telling reminder that technologies are never truly radical, but evolutionary.

13 cf. Newbizz N° 135084, 25-01-2001, special issue “Help! The minitel strikes back”, edited by P. Agède, http://www.01net.com/rdn?oid=135094&rub=1569&page=0-135094

Tables and references

Table 1 : Internet connection in relation to company size (In percentage of companies)

Company size	Total	20 to 49 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 or more employees
Internet connection (percentage of companies)						
1997	28,2	19,2	28,7	41,4	61,5	75,4
1999	68,7	58,5	76,7	88,3	93,3	97,3

Sources: Sessi-Survey ICT 1999 and IT1997

Table 2 : The spread of the Internet 1997-1999

	Internet connection (in percentage of company size)	
	1997	1999
Apparel and leather industries	13,6	49,6
Mineral product industries	21,5	53,2
Wood and paper industries	18,2	59,6
Metals processing and metalworking	18,8	60,5
Textile industries	21,9	64,3
Shipbuilding, aircraft and railroad equipment	40,8	67,4
Automobile manufacturing	31,3	69,4
Mechanical engineering products	23,7	69,9
Home appliances, furniture and other durables	28,9	72,8
Chemicals, rubber and plastics	34,5	74,5
Printing, publishing and reproduction	38,9	78,1
Pharmaceuticals, fragrances and cleaning products	53,9	80,0
Electrical and electronic components	45,2	89,7
Electrical and electronic equipment	61,3	91,2
All industrial sectors	28,2	68,7

Sources: Sessi-Survey ICT 1999 and IT1997

Table 3: Industrial companies and the internet

In % of companies	Internet connection	Website	On-line ordering capability	Intranet network	Extranet network
Large companies	97.7	70.5	13.6	79.1	37.2
Small- and medium-sized industries	67.6	38.1	8.9	19.3	8.6
High technology	85.6	51.5	9.2	36.5	16.8
Low technology	64.3	36.2	8.9	17.4	7.8
Export ratio > 25%	83	52.4	10.2	33.4	16.7
Export ratio < 25%	64	35	8.6	17.3	7.3
Subsidiaries of groups	82.1	47.9	9.5	38.4	15.8
Inc/. foreign groups	*85.7*	*46.3*	*9.8*	*6.5*	*20*

Independents	59.2	33.3	8.6	9.5	5.3
Innovative companies	80.5	49.6	11.1	28.6	13.2
Incl. Product innovation	*81.6*	*51.1*	*11.3*	*29.5*	*13.5*
Non-innovative companies	58.7	30.5	7.3	15.2	6.6

Source: Sessi-survey ICT 1999

Table 4: TIC: Industry or services

Industry :more than 20 employees Services:more than 30 employees or 4,5 M€.		Computers		Télécommunications		Électro-nics	Media	Total ITC	
		Industry	Services	Industry	services	Industry	services	Industry	Services
Companies		59	1 379	258	120	874	352	1 191	1 841
Employees		41 877	161 920	92 560	189 729	138 106	40 541	272 543	392 190
Turnover excluding taxes.	M€	12426	20 464	18410	28474	23900	11779	54736	60717
Exportation rate	%	44	8	46	5	47	7	46	6
Value-added rate	%	28	56	29	60	29	47	29	56
Investment rate	%	8	15	10	29	13	11	11	21
Profitability	%	- 2	5	35	54	- 5	1	9	29
Profit margin	%	26	27	17	51	18	54	20	43

Source : Sessi, Statistics of french ICT industry, 2000)

Table 5: Exports in telecommunications industry

	Companies	Employees	Turnover (exc. Taxes)	Export rate
1990	200	69 903	7235	16,5%
1991	196	62 578	7774	19,5%
1992	205	58 113	7458	23,7%
1993	174	53 111	7622	26,2%
1994	189	54 840	8769	30,8%
1995	221	62 881	10283	30,1%
1996	208	69 222	11313	32,4%
1997	208	69 689	12310	40,2%
1998	203	75 357	15620	47,2%

Source : Sessi, Statistics of French ICT industry, 2000

Table 6: Exporting French Telecommunications: Europe first

MOST IMPORTANT EXPORT DESTINATIONS SALES	1999
U.K.	13%
Germany	11%
Nederlands	7%
Spain	6%
Italy	5%
Total worldwide export	6.6M€

Source : Sessi, Statistics of French ICT industry, 2000

Table 7: Concentration in Computer industries

	0 à 19 employees	Part of computer industry
Companies	295	82,9%
Employees	1 484	4,2%
Turnover (exc. Taxes) M€	197	1,7%
Investments M€	3	1,1%
Export rate	5,5%	0,2%

Source : Sessi, Statistics of French ICT industry, 2000

Table 8: Newly Created Firms

	1996	1997	1998	1999
Technology suppliers (computers, infrastructure...)	339	345	299	286
Services and technology users (retail, telecommunications services, software...)	5386	5652	6312	6681
Multimedia services (radio, TV, media...)	1082	1068	1007	1160
TOTAL OF ITC FIRMS	6 807	7 065	7 618	8 127
Total of Newly created firms in France	171 628	166 850	166 191	169 674

Source Sessi, Statistics of French ICT industry, 2000

Table 9: Examples of Internet Usage Distribution Data

	France	Great Britain	Germany	United States
Web	97.3%	97.2%	96.2%	97.9%
Mail	64.9%	58.1%	51.1%	37.5%
Audio-Video	12.6%	12.1%	11.3%	4.0%
Forums (news)	8.0%	8.7%	5.9%	1.3%
On-line discussion (chat)	10.2%	5.4%	4.6%	1.2%

Household connection times

	France	Great Britain	Germany	United States
< 6 months	30.1%	27.1%	27.4%	16%
6 months - 1 year	17.2%	18.3%	13.8%	10%
> 1 year	52.7%	54.8%	58.8%	74%

Source NetValue (1999) (http://www.netvalue.com/)

Table 10 : Number or European users in 1998 (millions)

	Number of users (millions)	*Percentage of population*
Germany	4.3	5.1
UK	4.1	6.6
Sweden	1.4	15.6

France	1.2	2.1
Norway	0.9	20.5
Netherlands	0.8	5.1
Finland	0.7	13.7
Spain	0.6	1.5

Source: eStats, *(http://www.estats.com/) (1999)*

Table 11 : PCs per 100 inhabitants (1993-1997)

	1993	1994	1995	1996	1997
France	10	12	13	18	20
Germany	13	14	17	24	26
Great Britain	13	15	19	25	27
Usa	27	30	33	48	49

Source : Konert (1999)

Table 12 : Internet hosts per 100 inhabitants in Western Europe and United States, Jan. 1998

USA	Finland	Norway	Sweden	Denmark	Netherland	*UK*	Germany	Belgium	France	Spain	Italy	Greece
7.8	8.8	6.6	3.6	3.1	2.4	1.7	1.2	0.9	0.6	0.4	0.4	0.3

Source : Konert (1999)

Table 13: Comparing uses of Minitel and Internet

Use of Minitel	1993	1994	1995	1996	1997	1998	1999
Minitel terminals (millions) *	6,71	6,91	7,16	7,77	8,00	8,06	8
Cumulated Minitel consultation time * (millions of hours per year)	112	115	106	104	101	n.s.	n.s.
Cumulated Minitel consultation time excluding electronic directory ** (millions of hours per year)	89,7	87	84	85	83	80,5	74,7
Cumulated Internet consultation time (millions of hours per year)				0,6	3	8	17,02

Source * France Telecom Operindic/ Sagatel 2001 ** OCDE (1999)

Use of Internet	1993	1994	1995	1996	1997	1998	1999
Cumulated Internet consultation time (millions of hours per year)*	n.s.	n.s.	n.s.	0,6	3	8	17,02
Internet french hosts (millions) **	0,05	0,07	0,14	0,22	0,35	0,49	1,21

Source * AFA (Internet Access Provider French Association (2001) http://www.afa-france.com/html/chiffres/index.htm
** AFNIC (French Network Information Center) (2001) http://www.nic.fr/statistiques/afnic/fr-host.html

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